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ABSTRACT

The World Wide Web has become a promising medium for delivery of instruction. This paper describes a case study in which the Internet was used to supplement teacher education course instruction via an Interactive Web module. The goals of using such a medium for facilitating teaching and enhancing learning are described as they relate to learning theory. Such goals include improving informal assessment opportunities, increasing study evaluation opportunities, and increasing students' opportunity for inquiry based and project based unit plan construction. The Interactive Web module has been implemented for two years in a teacher education course and has been modified based upon student surveys. This paper also describes the survey results and modifications that were made to the Web Module accordingly. Preliminary research on the use of this Interactive Web module is described as well as plans for future research. (Author)

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The Goals and Development of an Interactive Web Module For a Teacher Education Course

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Abstract: The World Wide Web has become a promising medium for delivery of instruction. This paper describes a case study in which the Internet was used to supplement teacher education course instruction via an Interactive Web module. The goals of using such a medium for facilitating teaching and enhancing learning are described as they relate to learning theory. Such goals include improving informal assessment opportunities, increasing student evaluation opportunities, and increasing students' opportunity for inquiry based and project based unit plan construction. The Interactive Web Module has been implemented for two years in a teacher education course and has been modified based upon student surveys. This paper also describes the survey results and modifications that were made to the Web module accordingly. Preliminary research on the use of this interactive Web module is described as well as plans for future research. The Web site is located at

Introduction

A new model of utilizing the Internet for learning involves interactive techniques where there is active participation and interaction between faculty and students, students with other students, and students with electronic books, journals, and multimedia resources (Moore, 1991). The goal is not to use the Internet as a static tool, but instead to use the Internet to enhance interactivity and learning. The goals of enhancing learning through the use of an interactive Web module on the Internet, within a pre-service teacher education course, might facilitate the use of technology among future teachers. In the *Report to the President on the Use of Technology,* it was found that there continues to be a need for increasing the use of technology among teachers and their students within K-12 schools (1997). If the use of technology is to improve within K-12 schools then teachers must receive adequate technology training during their pre-service teacher education coursework to provide exposure to and improve attitudes toward the use of technology. Attitude-behavior theory suggests that beliefs about an object lead to an attitude toward it and that attitudes are an important precursor of behavior (Fishbone, Azjen, & Belieef, 1975). Consequently, there has been a good deal of research investigating the way computer-related attitudes and beliefs affect the use of computers by students and adults (Chen, 1986; Rosen, Sears, & Weil, 1987).

The goals of integrating technology through an interactive Web module within this EDUC 539 pre-service teacher education course, as outlined by this case study, are to demonstrate to pre-service teacher education students how interactive technology can support the learning process in a course other than technology. Over the course of two years, an attempt has been made to enhance learning of teacher education students via the use of interactive technology, specifically an interactive Web module, and also to solidly model the use of interactive technology in a teaching environment. It was thought that by providing the opportunity for pre-service teacher education students to use technology as an integral part of their own learning process, their attitudes would improve regarding technology.

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Consequently, these students would be more likely to use interactive technology as future teachers to support their students' learning in all content areas.

Learning Goals of Interactive Web Module Development

The World Wide Web is ideal for teachers who wish to use interactive technology to enhance learning within their courses. Since the Web is a newer medium that requires its own presentation style, careful planning is required to building effective Web pages that use learning theory as their guide. The learning goals of the development of the interactive Web module for this case study are described below along with the learning theory that supports these goals.

Improved Classroom Discourse and Higher Levels of Reasoning

EDUC 539 students have access to the lecture notes on-line and are therefore able to write down and engage in the deeper level of analysis that occurs through classroom discourse as opposed to only processing the main ideas. According to Vygotsky (1986) the use of social dialogue and interaction is an essential part of the learning process. Additionally, analytical and synthesis levels of the cognitive domain comprise essential components to the overall development of higher order thinking skills, yet teachers rarely engage students beyond the knowledge level (Elliott, Kratochwill, Littlefield, Travers, 1996). When provided the opportunity to download a hard copy of the main ideas to be discussed in class, teachers can save in-class time to model the concepts, have students apply the concepts, as well as engage the students in deeper level and higher order processing.

Primary critical thinking questions are developed for each lesson and posted at the beginning of the semester so students can review all of these questions at their own pace. Additional critical thinking and applied questions are occasionally devised directly after a class meeting either through the use of a distribution list or the University's chat room so that the instructor can gauge the questioning around student discourse from the prior class session. In doing so, the instructor can reinforce student learning and all students in the course can review their classmates' responses and applications of concepts as a way of evaluating their own understanding. Students can utilize the critical thinking and applied questions as a pre and post-reading tool and as a study guide for their formal assessments. Signaling techniques are advanced organizers that provide a framework for the reader and give cues as to the contents and major themes of the reading passage. They emphasize a passages' organization and conceptual structure (Mayer, 1984) and have been found to increase comprehension (Loman & Mayer, 1983). By providing downloadable lecture notes and critical thinking questions, students who may have processing, auditory or visual motor deficits will benefit as they can view and process the lecture notes outside of the natural classroom time constraints. Teachers can utilize the critical thinking question section by assigning specific questions to students ahead of time; this is particularly useful for students with a processing deficit. All students may benefit by the symbols and pictorial representations as well as the graphic organizers, which are a part of the slide show lecture notes. It would be difficult for students to duplicate these elements of the lecture notes during in class time.

Informal Assessment and Scaffolding

On-line Assignments

The instructor of the course can also create downloadable files which generate tasks that have been broken into short term goals leading to long term course objectives. Students can peruse the scaffolding assignments at any time rather than wait for the hard copy to be distributed in class. When the hard copy of each assignment is then presented to the students, the instructor has balanced the pace of the whole class with the needs of the individual student or group. The downloadable files which support long range goals represents a form of scaffolding by which the course instructor simplifies the task so the student can manage certain components to the overall goal. The instructor also presents cognitive modeling where prompts or cues in the form of the assignments can help the student progress to the next step (Good & Brophy, 1995).

Web Based Testing

Web Based Testing takes Computer Aided Assessment one step further by using Web servers to deliver tests and store student responses in a database. Tests can be multiple choice, fill in the blanks, true or false, or short

answers. The CGI template used to create the multiple choice test is available from . Instructors can tailor their questions to reflect the type of objectives they are covering in their course. Students in EDUC 539 were given a solid framework as a review for their mid-term exam, and were also able to monitor their own understanding of concepts by comparing their responses to the correct answers. This Web based testing represents a cognitive behavior modification technique designed to help students develop goal setting behavior, planning, and self-monitoring (Good & Brophy, 1995), and provides the opportunity for students to master the concepts (Bloom, 1981). The questions on the Web served as benchmarks for students and for the instructor in that students were able to respond to each question after the concept was covered in class to determine their level of understanding. If students responded inaccurately, they would go back to their text, e-mail their instructor, or ask in class for clarification of the concept.

Student Evaluation and Improved Quality of Assignments

Models of former students' exemplary work can also be placed on the Web site as downloadable files or in html format. This serves to support the quality of students' work and represents another component to scaffolding where the instructor has presented an idealized version of the course assignment as a guideline for students to follow (Good & Brophy, 1995). The cognitive modeling occurs while students are exploring each phase of the former students' projects and comparing their product to those they are examining. Students are given a number of projects to view in-depth so that they are able to analyze the intricacies involved in the project assessment such as how multiple perspectives were explored, what critical thinking looks like in writing, how to tailor a product to its intended audience, etc. This leads students to the evaluation level of the cognitive domain objectives in that students are able to compare their work to external criteria (Bloom, 1981). Authentic teacher based products can also be linked to the Web page so that university pre-service teacher education students can recognize, comprehend, and construct products that integrate theory with real practice. This supports students' ability to accomplish the application, analysis, and synthesis levels of the cognitive domain objectives in that these objectives require multiple perspective taking and compiling seemingly disparate components into a new problem solving context (Bloom, 1981).

Inquiry Based and Project Based Assessments

Web Conferencing

Within the classroom, Web Conferences can be used to create small group discussions organized either by topic areas or student groups. Multiple, concurrent discussion groups can be setup and anyone using a Web browser can participate in these conferences. Participants can post, reply, send e-mail messages, attach files, and host real-time chat discussions. The course instructor can moderate discussions and provide direction to the topic being discussed or answer questions posted to conferences by students. The course instructor can also include professionals in the field within the Web Conferences, and can therefore create a community of learners beyond the physical boundaries of the classroom.

Preliminary Analysis

Data has been collected through student e-mail transcripts and chat room discussions, observations of in-class interaction, interviews, and student surveys. The results of this empirical data analysis follow.

Benefits to Instructor

As a result of Web based testing, opportunities for Web conferencing, and critical thinking questions posed through e-mail, the course instructor was better informed about what students were understanding, as well as about the concepts which still needed clarification. The instructor maintained an ongoing historical document of dialogue with students, kept records of common questions asked, and presented questions and responses to all students at the beginning of the class lecture. This provided a perfect summary and/or review by the teacher as it recognized the cognitive misconceptions held by the students and enabled the students to move beyond basic levels of understanding. Students were also able to determine their own level of concept recognition and comprehension and they were able to self-regulate and adjust their understanding when needed. The use of chat room facilitated group

discussions as well as discussions among educational practitioners. The chat room brings more structure to the E-mail environment and builds in *configuration control* in that students are able to build off of one another's ideas and see where they have been and how they got to the line of current thinking and product development. Overall, the interactive Web module enabled the instructor to: 1) monitor concept recognition of the class as a whole; 2) post questions immediately following class associated with what has been discussed in that class; 3) monitor where to begin the next class by adding layers of questioning starting with what the instructor knows the students' knowledge base to be; 4) reflect on the ongoing nature of the learning process in a way in which pre-determined questions cannot; 5) scaffold student learning by identifying students' scheme and building upon it; 6) feel confident that all students have the opportunity to see an idealized version of assignments required that model products of the highest standard.

Benefits to Students

The use of a Web site to post student work provides positive reinforcement for the student who created the work as they see their finished product published to a wider audience. As one student indicated "*Your offer to consider my project for publication on your site has motivated me to a higher sense of purpose. I only hope that I can produce a project worthy of your consideration*". Another student who constructed a History/Social Science interactive tour on the Web for EDUC 539 wrote "*I wanted to let you know that the class I took from you recently serviced me here at work. Along with a colleague I was invited by A&E's 'The History Channel' to write K-12 curriculum for one of their films "The Lincoln Assassination". The curriculum will go out to K-12 teachers all over the country when they order any of the films…….*". Additionally, the display of on-line student work tangibly demonstrates to subsequent students what the instructor's expectations are for a given assignment and gives them a dynamic model to emulate in their own work.

Disciplined inquiry relates to the discovery of authentic and complex components to any concept or research topic (Bruner, 1990). EDUC 539 students engaged in disciplined inquiry through the multiple links to theory and teacher based products provided on the Web module. As one student indicated "*By the way I love the web page especially the ERIC link. It is a dream come true!!! Thanks a million.*" Another student in EDUC 539 designed a Web site for History/Social Science teachers and their students. The EDUC 539 student created a tour that provides the audience of high school teachers and their students access to historical links containing a variety of resources such as artifacts, museums, architectural structures, artists and their paintings or musical pieces. This EDUC 539 student used the disciplined inquiry model provided to him by the EDUC 539 interactive Web module to create such a product for high school teachers and their students.

Email Analysis

An analysis of approximately 40 Emails over the course of two semesters revealed that 41% were related to assignments and gaining a better understanding of instructor expectations, or exploring possible approaches to assignments, 24% expressed reflective or critical thinking regarding classroom concepts or discussions, 20% were exchanged in support of group projects, 7% provided additional information to share with classmates/instructor, and 7% dealt with outside experts. An example of extended classroom discourse that demonstrates critical analysis and reasoning can be seen here, "*A good discovery lesson seems to hinge a lot on the teacher--although one of the main criticisms of discovery learning is that the teacher's role is too ambiguous. Our favorite behavioralist, B.F. Skinner describes discovery learning as a method 'designed to absolve the teacher from a sense of failure by making instruction unnecessary.(B.F. Skinner, The Technology of Teaching, p.109)'……..Skinner creates a slippery-slope type of argument. In fact, he virtually equates a student's 'discovery' as requiring the same amount of genius as that of the original discoverer. Thus, when a student may be set up through a tactful curriculum to discover, say, the concept of a heliocentered solar system, that student would have to make the same conceptual leap as did Galileo. I think it's all a matter of designing the discovery unit in such a way that valuable insights are virtually inevitable. That's where a clever teacher comes in; one who is able to provide enough pre-reading and who is also adept at de-briefing the class at, say, the end of a simulation. These and other scaffolds can help the non-Galileos to see farther and with more clarity than they would on their own, while also preserving (at least superficially) their intellectual independence. To those who claim the discovery approach is worthless, let them be reminded of Einstein's great flash of insight: a mental picture of a man falling off a rooftop spurred him into developing the Theory of Relativity.*" The use of e-mail seemed to open up a more comfortable means of communication for some students who were more reticent to ask questions or share ideas in the whole class context, and it provided the time needed

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for discussion outside of the class context. As one student explained, "*E-mail provides a great discussion forum as we have time to present ideas which would not be aired in class due to constraints of time*".

Survey Data Analysis on the Utility of the Web Module Features

Additional pre-analysis was done based on a pilot survey of EDUC 539 students who had been exposed to the interactive Web module during the Fall 1997 semester (Table 1). Out of those students who responded to the survey, 100% accessed the Web module outside of the classroom environment. The elements of the Web module which students found most valuable were (in decreasing order) links to references (ERIC, learning theorists, etc), interactive mid-term, lesson plan examples, learning project examples (samples of student work from previous semesters), and lecture notes. Students were also asked to describe aspects to the Web module they found difficult; this information is described in the Recommendations *and Future Research* section that follows.
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Did you access the 539 Home page outside of the classroom environment?	**100% Yes**
On a scale of 1 to 5, with 1 being "Of No Use" and 5 being "Extremely Useful", how would you rate the utility of the web page?	4.2
Utility of Lecture notes?	4.5
Utility of Critical Thinking questions?	4
Utility of Lesson plan examples?	4.6
Utility of Learning project example?	4.1
Utility of Links to local school district sites?	3.1
Utility of Links to standards?	3.7
Utility of Links to Reference sources (ERIC,learning theorists, etc)?	4.7
Utility of Link to GMU E-mail/online account establishment?	4.1
Utility of Interactive mid-term?	4.4
Did you take the interactive mid-term quiz?	91% Took it
On a scale of 1 to 5, with 1 being Extremely Difficult and 5 being Extremely Easy, how would you rate the ease of access to the web page?	4.3
On a scale of 1 to 5, with 1 being "Of No Use" and 5 being "Extremely Useful", how would you rate the ability to communicate via E-mail?	4.7
On a scale of 1 to 5, with 1 being "Not At All Comfortable" and 5 being "Extremely Comfortable", how would you rank having to submit your learning project contract via E-mail?	4.1

Table 1: 1997 Fall semester student survey assessing the utility of the interactive Web module features. 85% of the students in the course responded to the survey; 55% were female, 27% male, and 18% were unspecified. 36% were of the age 21-30, 18% were 31-40, 9% were 41-50, and 37% were unspecified.

Recommendations and Future Research

The student survey also highlighted some technical problems that instructors might encounter, or might seek to avoid. Although the Web/technical environment is rapidly moving toward complete interconnectivity, there is still an array of hardware and software in use and some incompatibilities are almost inevitable. As a result of this initial survey, downloadable files were placed on the ftp server as rich text format (*rtf)* and the lecture notes on PowerPoint were converted to html, which allowed the files and lecture notes to be read by Macintosh computers as well as all word processors. Changes were made to the Web module that considered how students could be taught the interface elements of the Web module, and how students could benefit from the Web module even if they did not have a computer at home. Students were given an Internet lesson during the first class. Additionally, the instructor avoided posting assignments only on the Web, and critical thinking questions and lecture notes were posted in the beginning of the course to enable students the time they needed to access a computer from a University lab or public library. The instructor created and utilized the Web module for components of the learning process that would otherwise not be readily available to students without this medium such as lecture notes, streamlined searches by topic, and examples of former students' work. Adults who have difficulty coming to the University outside of class

time, can take advantage of the opportunity to view former students' projects without physical time restrictions. It is equally important to recognize that the integrity of the classroom learning environment for activities such as collaborative learning and personal rapport building need not be lost once technology has been integrated as an instructional tool. Instructors will want to consider the logistics of the classroom in order to maintain a collaborative and personal learning environment.

A research study design is being developed that would assess student learning over the past years of participation within this interactive Web course module. Additionally, data is currently being analyzed to assess whether or not participation within an interactive Web module affects attitudes towards and intent to use technology as current or future teachers.

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